AN ANALYSIS OF
ENTEROCUTANEOUS FISTULAS

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CERTIFICATE

This is to certify that this dissertation in **"AN ANALYSIS OF ENTEROCUTANEOUS FISTULAS"** is a work done by **DR. SANDEEP. U.,** under my guidance during the period 2005-2007. This has been submitted in partial fulfillment of the award of M.S. Degree in General Surgery (Branch – I) by the Tamilnadu Dr. M.G.R. Medical University, Chennai – 32.

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CONTENTS

INTRODUCTION

Enterocutaneous fistulas develop most commonly as a postoperative complication of bowel surgeries, though in 15 to 20% of cases, they occur spontaneously. Spontaneous fistula may arise in patients with inflammatory bowel disease, radiation enteritis, diverticular disease, perforated duodenal ulcer, pancreatic and gynecological malignancies. Crohns disease is the most common primary bowel disease leading to enterocutaneous fistulas. Surgical treatment may be difficult because additional fistulas may develop in these patients postoperatively.

The vast majority of fistulas occur in the postoperative setting. They are frequent after emergency surgeries, when the patient preparation is poor or in the chronically debilitated and malnourished patients.

The common causes include disruption of anastomotic suture line, unintentional enterotomy, or inadvertent bowel injury during closure.

They remain one of the important challenges to the surgeon because of their anatomical abnormalities, metabolic derangement and extensive sepsis associated with them.

HISTORICAL ASPECTS

History dates back to 1043 BC when Samuel has written about Eglon, who sustained post traumatic fistula in The Old Testament Book of Judges. “And Enad put forth his hand, and took the dagger and thrust it into his belly… And the dirt came out.”

FISTULA is a word coined from a similar Latin word for pipe. It also has a French origin from the word ‘Festre’ which led to the English word ‘Fistle’ and ‘FISTULA’.

Until 18th century, management of fistula was by an attempt at surgical closure as advocated by Celsus which resulted in most number of failures in the management of fistula. During the 18th Century, a Paradigm shift in the management of fistula advocated by John Hunter, favored conservative therapy of wait and watch policy for spontaneous closure.

AIMS OF THE STUDY

The aims of this study are to analyze all cases of enterocutaneous fistulas treated at Government Royapettah Hospital, Kilpauk Medical College, from June 2005 to September 2007 and

1. To identify the factors influencing spontaneous closure and mortality in patients with ECF.

2. To determine serum albumin levels by which we can accurately predict the outcome of patient with ECF.

3. To assess the importance of parenteral nutrition in the management of fistula.

4. To search for effective preventive measures on this enervating and demoralizing phenomenon.

Various literatures have been reviewed and are discussed in detail.

REVIEW OF LITERATURE

A fistula is an abnormal communication between two epithelialised surfaces. An internal fistula connects two hollow viscera or potential spaces with each other. External fistulas connect a hollow viscus to the body surface. Simple fistulas have a single direct tract, whereas complicated ones have multiple tracts or an associated abscess. Lateral fistulas have a leak from the side of a hollow viscus and end fistulas have a leak from the whole diameter of the section of the involved bowel.

Historically, the earliest record of an ECF appeared in the Old Testament book of judges (1043-1004 BC.), it is the account of Eglon, who sustained an acute posttraumatic ECF. Thilesus in 1670 reported biliary fistula due to spontaneous perforation of gallstones through the abdominal wall. Teale in 1841 reported a fistula in a strangulated inguinal hernia. Alexis St. Martin developed a gastric fistula following a gunshot wound and was used by Beaumont in 1833, as a means of researching gastric physiology. While John Hunter advocated a conservative approach to fistulas in the 18th century, Celsus described the first attempt at surgical repair of an ECF.

CLASSIFICATION

The most commonly used schemes for classification are anatomic, physiologic and etiologic which are not exclusive of one another.

Scheme	Classification	Significance
Anatomic	Internal External Organ Involved	Suggests etiology, Prognosticates spontaneous closure, helps plan operative time and approach.
Physiologic	Output (ml/Day) Low <200 ml Moderate 200 to 500 ml High> 500 ml	Prognosticates mortality but not spontaneous closure, assist in anticipating and treating metabolic deficits.
Etiologic	Underlying disease process	Prognosticates spontaneous closure and mortality

Sitges - Sera et al proposed an alternative classification of postoperative ECF which integrates the role of nutrition, surgery and prognosis of a given patient, which can be used a guideline to treatment.

Group1: Oesophageal, gastric, small bowel and ileocolic fistulas

a: Low Output (<1000 ml/48 hr)

b: High output (>1000 ml /48 hr)

Group 2 : Fistulas through a large abdominal wall defect

Group 3 : Appendiceal and colo-colic fistulas

ETIOLOGY

ECF are usually acquired but are occasionally congenital, e.g. a patent vitello intestinal duct with a fistula. Acquired fistulas may be spontaneous or post operative. Spontaneous fistulas occur when a disease extends out of the organ of origin to invade surrounding tissues. Postoperative fistulas are a consequence of loss of integrity of the intestine.

Leakage of intestinal juices causes localized infection, abscess formation, and burrowing of septic focus into body surface. A wound abscess appears 5 to 6 days after surgery and is drained. Within the next 24 hrs, enteric contents appear on the wound surface. Both local and systemic factors like infection, inflammation, distal obstruction, malnutrition, immunosupression etc. influence fistula formation.

In the early 1900s, most fistulas were spontaneous. Lewis et al reviewed 109 cases of ECF from John Hopkins Hospital, Baltimore from

1891-1931 and showed that almost 60% were associated with infection. Appendicectomy was responsible for less than 20% of all ECF. After 1960, the majority of ECF are postoperative.

Spontaneous causes include radiation, inflammatory bowel diseases, malignancies, tuberculosis etc. Postoperative enterocutaneous fistula usually follows operations for cancer, IBD and adhesions from previous surgery. Other causes include operations for peptic ulcer, pancreatitis, trauma etc. Fistulas more commonly occur following emergency surgery. Systemic abnormalities that impair wound healing like sepsis, steroids, diabetes, chemotherapy also influence the formation of postoperative fistulas.

More than half of postoperative enterocutaneous fistulas are due to unrecognized bowel injuries during adhesiolysis or abdominal closure. The remaining is due to disrupted anastomoses.

This may be due to inadequate blood flow as a result of devascularization or systemic hypotension, tension on the suture lines, perianastomotic abscesses, anastomosis on diseased bowel, inadequate bowel preparation, poor drain placement and malnutrition.

Gastric fistulas are postoperative in 80 to 90% of the cases. The average time for closure is 40 days and overall mortality is 20%. Duodenal fistulas are postoperative in 50-80% of cases, overall mortality is 30% and spontaneous closure occurs in about 20 days.

Small intestinal fistulas are the commonest type of ECF encountered, of which 70 to 90% are postoperative. Other causes include Crohns disease, cancer, etc., mortality is 20 to 40%. Chronic fistulas occur as a result of IBD, diverticulitis, cancer and radiotherapy or secondarily from surgical treatment of these diseases. Most of these heal spontaneously in 30 to 40 days, mortality is 10 to 20%.

As the majority of ECF are due to technical failures, well vascularised, tension-free anastomoses performed in healthy bowel in nutritionally replete patients, will decrease postoperative complications in general and fistula formation in particular.

COMPLICATIONS

The major morbidity and mortality from ECF are related to 3 complications –fluid and electrolyte imbalance, malnutrition and sepsis. The initial metabolic consequence of an ECF, especially the high output one is loss of water and electrolytes and the severity increases as the fistula gets closer to the ligament to treitz.

The daily volume of secretions in to the gut amounts to 20% of total body water. Also each day, 1/3rd of the total exchangeable sodium and chloride in the body is secreted into the gut and reabsorbed and 20% of the body's extracellular potassium is secreted into the gut per day.

Fluid and electrolyte imbalances accounted for 78% of deaths in ECF in the 1960's but improvements in fluid management has decreased the mortality by more than 50%. Dehydration, hyponatremia, and metabolic acidosis are common problems.

Malnutrition is a major problem in ECF. Scoeters et al noticed a 74% incidence of malnutrition in his series of patients with ECF. Coutsofides noted a 66% incidence of malnutrition and found that, mortality was 32% in the malnourished and only 4% in well-nourished patients. Malnutrition is

more severe in high output fistulas due to hypercatabolism, lack of adequate nutrient intake and loss of protein rich secretions from the fistula.

Sepsis is the most common complication and cause of death in ECF.

Unless sepsis is controlled, it is impossible to correct malnutrition.

MANAGEMENT

There are five phases in the management of an ECF

1.	Stabilization	:	Within 48 hours
2.	Investigations	:	after 7-10 days
3.	Decision making	:	10 days to 4-6 wks
4.	Definitive Therapy:		after 4-6 wks
5.	Healing	:	5 to 10 days of closure

The aim of stabilization is to control the three major complications of a fistula and consists of rehydration, electrolyte repletion, correction of anemia, drainage of sepsis, restoration of oncotic pressure, nutritional support, control of fistula drainage and institution of skin care.

A period of stabilization allows the peritonitis to subside, inflammation to resolve and improvement of the nutritional status. This improves the outcome of subsequent surgery, if spontaneous closure has not already occurred. The priority is to restore circulatory volume and correct

electrolyte imbalances. Initially a peripheral venous line is used. Once the patient is stabilized, a central venous catheter is preferable to deliver fluids.

The deficit caused by a fistula is directly proportional to the volume and composition of the effluent and the rate at which it is lost. The composition of the fistula output and of the fluid that correlates with the anatomic location of the fistula may not be the same. Hence the fistula effluent must be collected accurately and its volume and composition measured. Resuscitation is best carried out with a plasma expander followed by crystalloids. Blood is used only if there is extensive blood loss. CVP monitoring is mandatory for correction of fluid balance.

The daily requirements are 35 to 45 mI/kg water, 75 mmol Sodium and 70 mmol potassium. To this, daily fistula losses must be added. Fluid and electrolyte requirements must be reviewed everyday initially. Good guides to the adequacy of replacement are the urine sodium level and urine: plasma osmolality ratio, which can give an early warning of fluid overload.

Routine use of nasogastric tube has been advocated by Tarzani et al, but several series have failed to demonstrate improved outcome with use of NG tube in distal or low output fistulas.

Antisecretory drugs like ranitidine, omeprazole, or somatostatin (Octreotide) can reduce fistula output. When compared to TPN alone, Octreotide does not improve overall closure rate but in a collected series, the closure time decreased significantly from 50 days with TPN alone to 5 to 10 days when Octreotide was also used, Boike et al reported on 27 patients with ECF, treated with Octreotide and showed decreased fistula output by 55% in first 24 hours. A 77% spontaneous closure rate was achieved with TPN and Octreotide after an average of 5.8 ± 2.7 days, compared with 4 to 6 weeks of TPN alone.

Nutritional support has become the mainstay in the management of ECF improving the outcome. To optimize nutrient metabolism, circulation and tissue oxygenations must be adequate. The goal of nutritional therapy is nitrogen equilibrium with maintenance or restoration of structural and functional protein synthesis.

Nutritional support is started soon after resuscitation. Oral intake is stopped while determining the optimal route for nutritional support. Hull and Barnes first observed that total parenteral nutrition actually reduced fistula output. This was confirmed in clinical studies by Chapman, Mac fayden and Kaminiski. Elemental diet was also shown to reduce fistula

output. Wolfe et al, showed in experimentally created fistulas in dogs, that fistula output and nutritional losses reduced by 81 and 93 % by using enteral and parenteral nutrition respectively.

Nutritional therapy is primarily supportive but may have a therapeutic role by modifying GI secretion. TPN replaces fluid and electrolytes, provides adequate nutrition and alleviates the catabolic state and reduces fistula output.

Parenteral nutrition is the initial method of support in ECF. The high osmolarity of TPN solution precludes the use of peripheral veins for delivery. So access to central veins like the subclavian or internal jugular is essential where the large blood flow immediately dilutes the nutrients.

For anabolism to occur, usable source of nitrogen and calories must be provided. Thus patients on TPN must have infused synthetic aminoacids containing an equivalent of nitrogen lost plus an additional 2-3 g with a suitable energy source. Energy requirement takes into account resting energy expenditure, stress factor and activity factor.

BME is calculated by Harris – Benedict equation,

For men: BME (K Cal /d) = 66.4730 + 13.7516 (W) + 5.0033 (H) – 6.7550 (A)

For women: BME (K Cal / d) = 655.095 + 9.563 (W) + 1.8596 (H) – 4.6756 (A)

Parenteral glucose should constitute the major caloric source in TPN and the rest should come from fat, as only glucose significantly suppresses gluconeogenesis. Fat can achieve protein sparing and supply essential fatty acids.

Additional requirements include essential fatty acids, vitamins, trace elements and hematinics. TPN has been reported to lower the mortality rates to as low as 5.3 %, though this has not been possible in other series. However TPN increases the rate of spontaneous closure.

COMPLICATIONS ASSOCIATED WITH USE OF TPN

Mechanical:

Catheter tip malposition

Arterial laceration

Hydropneumothorax

Subclavian or Superior Vena Cava thrombosis

Thrombophlebitis

Catheter embolism

Septic:

Catheter related sepsis

Metabolic:

Acute:

Hyperglycemia / Hypoglycemia

Parentral Nutritions

Electrolyte abnormalities

Fluid overload

Hyperlipidemia

Chronic:

Metabolic Bone disease

Alteration in bile composition

Deterioration of liver function

The introduction of 3 litre bags made of ethyl vinyl acetate has made the admixture of a fat emulsion to dextrose and amino acids possible. The advantages are:

1. Cost saving during preparation and delivery

2. More uniform administration of a balanced solution

3. Less manipulation and contamination

4. Obviation of care for peripheral catheter used solely for the administration of lipids, in order to avoid inserting a central venous catheter

5. Decreased lipid toxicity

6. Ease of delivery and storage for patients on home TPN.

7. The option of delivering nutritional support peripherally and

8. Reduced long term hepatic accumulation of triglycerides.

Enteral nutrition may be used after an initial period of TPN in oesophageal, ileal and colonic fistulas. Enteral nutrition especially glutamine supports gastro intestinal mucosal growth and function especially when the gut mucosal barrier is compromised. Short chain fatty acids are a fuel source for enterocytes. Levy et al reported spontaneous closure in 88% and mortality in 19% of patients treated with elemental diet. The efficacy of enteral nutrition has been reproduced in many studies. Meticulous catheter maintenance protocol and regular monitoring by clinical and lab tests are needed to prevent complications.

CATHETER MAINTENANCE PROTOCOL

Cut down site : Dry sterile dressing until wound heals, then no dressing

Catheter exit site : Daily skin cleaning with alcohol and 3% H_2O_2. Sparingly apply antiseptic ointment on dry sterile dressing

Catheter : Heparin flush following blood sampling or daily use

No Millipore filter

Monitoring the patient on TPN requires the following clinical data to be checked daily.

Patient sense of well being:

Symptoms suggesting fluid overload, high or low blood glucose electrolytes imbalance etc.

Patient's strength as judged by graded activity:

Getting out of bed, walking stair climbing.

Vital Signs : Temperature, blood pressure, pulse rate, respiratory rate

Fluid Balance : Weight, fluid input (intravenous ± essential) versus fluid output (Urine, stool, gastric suction etc.)

Delivery equipment for TPN : Composition of nutrition solution, tubing, pump, filter, catheter dressing (Skin checked for local infection at time of dressing change.)

LABORATORY DATA: Urine quantitative glucose: Daily until patient stable then twice weekly.

BLOOD:

Na, K, Cl, HCO_3, Glucose

Blood Urea Nitrogen

Albumin, Creatinine

Liver Function Studies

Ca^2, PO4, Mg^2

Cholesterol, Triglyceride

Prothrombin time, baseline, then biweekly

Micronutrient tests as indicated.

COMPLICATIONS OF ENTERAL NUTRITION

Mechanical complication: The mechanical complication of enteral feeding fall into two broad categories – low – frequency, high morbidity complications and higher frequency, low – morbidity complications.

Low frequency high morbidity complications include injury along the nasogastric tube insertion site, arterial erosion, perforation of the GI tract and aspiration pneumonitis. High frequency low morbidity mechanical complications consist mostly of dislodgement of feeding tubes with both weighted and unweighted tips as well as the red rubber tubes.

Metabolic complications: The metabolic complications and their frequency in enteral nutrition include fluid overload 31%, electrolyte imbalance 30%, hyperglycemia 30% and uremia and dehydration 15%, symptoms of abdominal bloating. Cramps and diarrhea are related to high rates of feeding and to the high caloric density of the formula (i.e., high fat content), although paralytic ileus and the side effects of para-sympathomimetic drugs must be excluded.

Among the pathogenesis of tube – feeding diarrhea is the use of contaminated tube feedings, lactose intolerance, high osmotic loads,

inappropriate release of gastrointestinal polypeptide hormones, concomitant antibiotic therapy, use of laxatives and hypoalbuminemia.

Infectious complications: Infectious complications are one of the most commonly reported side effects of enteral tube feeding. Bacterial contamination of the enteral nutrient solution has been reported to occur in 30% to 90% when using open enteral feeding system. This leads to diarrhea. Other factors include the use of enteral powders requiring mixing of either sterile or tap water to dilute the formula. A consequence of the diarrhea is its associated increased morbidity related to fluid and electrolyte losses. To minimize contamination of enteral nutrient solutions, it is recommended to use a closed delivery system, a prepacked sterile enteral formula, and a sterile administration set.

Indications for stopping nutritional support include life threatening complications, terminal illness and when fistula is close to healing. However, Meguid et al recommended waiting after fistula closure, until the patient eats 60% of his requirements before withdrawing nutrition supports.

Access to GIT may be oral, nasogastric or nasoenteral through a gastrostomy or jejunostomy. The various enteral feeds include disease-specific, elemental, whole protein, modular or supplemental feeds.

Nutritional requirements in ECF:

Fluids:	30 to 40 ml/kg/day
Sodium:	70 to 100 mEq/day
Potassium:	70 to 100 mEq/day
Calories:	35 to 40 kcal/kg/day
Protein:	1 to 1.5 g/kg/day
Nitrogen:	0.17 to 0.34 g/kg/day
N2 : NPC:	1:150 to 300
CHO: Fat:	70:30

Sepsis in ECF may be directly related to the fistula, like wound infection, or may be due to indirect causes like UTI, catheter sepsis etc. Eradication of infection may help heal a fistula spontaneously without

surgical intervention. The first step in managing sepsis is to provide adequate drainage.

This controls the fistula and protects the skin. Any local wound infection must be treated with incision and drainage or debridement if necessary.

If signs of sepsis are present, an intra abdominal abscess must be ruled out. If absent, other sources must be ruled out. Antibiotics must be used only after drainage of any intra abdominal sepsis. Abscess may be drained by percutaneous, transperitoneal or extra peritoneal routes. Percutaneous abscess drainage is the preferred method. Closure rates of 50 to 84% have been reported in low output fistulas by this method.

Reoperation for sepsis in ECF has a high mortality and must be considered only after other options are exhausted, but a patient must never be allowed to go downhill progressively without an operative search for occult sepsis.

The decision to proceed with operation in this setting should be undertaken only after all options have been thoroughly considered and risk versus benefit assessed. In most cases of patients with GI fistulas, when the

indication is sepsis or a sepsis related complication, the procedure is generally performed on an emergency basis.

In general it is best to identify and localize the intra-peritoneal location of the septic focus prior to re-exploration. The operative incision and approach should be governed by the nature and location of the infection prior to operation and the surgeon's experience. The act of re-entering the abdomen in a patient with a fistula may be quite challenging. Some surgeons advocate a new and separate incision through virgin territory, others prefer to go through the previous incision and attempt to isolate the fistula as a pedicle and carefully separate the incision from the viscera.

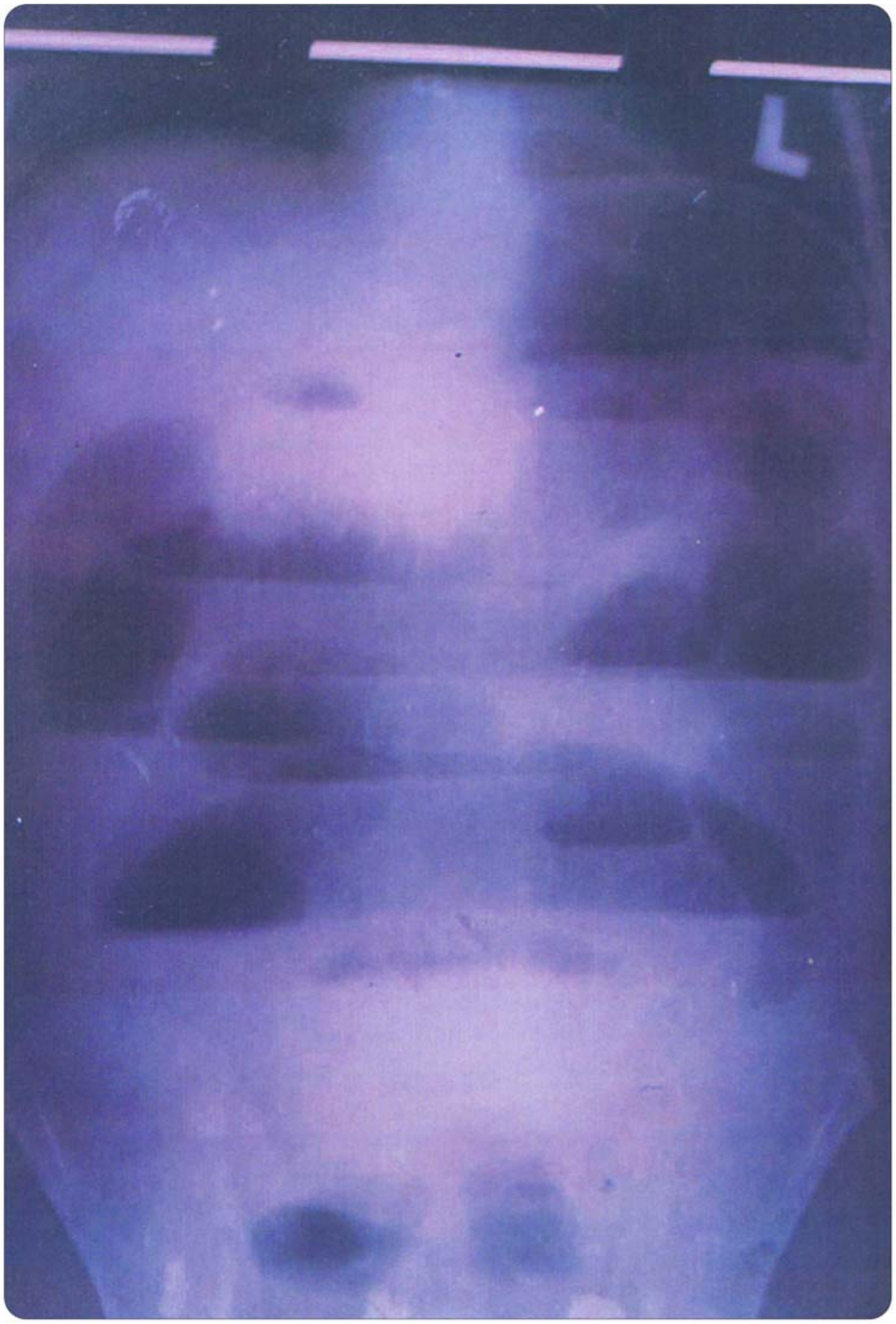
It is essential to expose the entire GI tract to be sure that there are no points of obstruction distal to the fistulous opening. Abscess cavities are drained, sampled for culture and irrigated, sialastic sump drains are left to drain any suspicious areas, particularly those with sticky fibrinous exudates. The drain should be brought through the abdominal wall with counter incision low in the flank, to offer the most dependent drainage from a supine position.

By the end of a laparotomy for drainage of abscesses, the intestine is often oedematous and filled with fluid, creating a much larger volume than that found upon entering the peritoneal cavity.

This creates increased tension on the abdominal wall when trying to re-approximate the edges of fascia. Under these circumstances there are a few options, one is to “Milk” the intestinal contents back into the stomach and aspirate them via the transgastric jejunal tube, gastrostomy or jejunostomy. Another option is to place a long tube such as a Baker, Miller-Abbott or their equivalent and again aspirate the luminal contents as much as possible.

Definitive surgery to close fistula must be avoided. However proximal diverting stomas may be considered. The abdomen may be left open and packed temporarily (Laparostomy), this helps in repeated inspection and abscess drainage.

Skin care aims to maintain skin integrity and contain due effluent and improve the patient’s morale. Various methods include use of absorbents, charcoal, transparent dressings, skin barriers, pouches and suction catheters.



X-RAY ABDOMEN SHOWING MULTIPLE AIR FLUID LEVELS

A closed system with suction or sump drain and lactic acid perfusion technique has also been used for skin care.

The factors that determine the choice of skin protection include origin of fistula, nature and volume of effluent, condition of skin, location, size and number of fistula openings.

High output fistulas need a pouch system and low output may be contained with dressing and skin barriers. Thick effluents are contained with a drainable type pouch and liquid effluents with a urostomy type pouch.

Skin barriers are used when effluent contains proteolytic enzymes or is extremely acidic/ alkaline. Pouches may be ostomy pouches or wound drainage and wide mouthed collectors. Skin barriers may be in the form of solid wafers, powder, paste, spray, ointments and creams. Fistula with large open wounds may be drained by saddle bagging and bridging methods.

Radiological investigations provide information regarding the origin, complexities and size of fistula, condition of adjacent bowel, continuity of bowel, presence of distal obstruction etc.

Fistulogram showing Fistula
Communication with small bowel

Contrast studies must be initially done with iodinated water soluble media. Thin barium may be used only in case a negative examination. Fistulography is the most reliable way of demonstrating communication with underlying viscera. Ultrasound, CT Scan, hydrogen peroxide enhanced ultrasound fistulography are other investigations that are useful in evaluation of EC fistulas.

DECISION MAKING AND DEFINITIVE THERAPY

The main goal of therapy in ECF is to reestablish intestinal continuity and close the fistula. This is most favourably achieved by spontaneous closure. The use of TPN has improved the rates of spontaneous closure. Still operative intervention is necessary in many patients to close the fistula, especially in ileal fistulas which close spontaneously in only 40 % of patients, due to small diameter, vigorous motility and relative obstruction of ileocaecal valve.

Emergency is indicated only in cases of sepsis or haemorrhage. Otherwise, conservative therapy is the treatment of choice in the initial period. The cases considered for late elective surgery are those in which the fistula has not healed after 4 to 6 weeks of appropriate conservative

management and those where local conditions preclude spontaneous closure. Reoperative surgery and conservative management are not opposing forms of therapy, rather they are complementary.

There are two categories of operation. The first include those designed to improve general condition (e.g. drainage of abscess), correct malnutrition (feeding enterostomies) or control output from a difficult fistula (proximal diversion).

In the second category are definitive operations to remove the fistula and diseased bowel. In a well nourished patient without sepsis, resection of fistula and end to end anastomosis is preferred. In a malnourished septic patient, proximal diversion or resection with exteriorization is done. Intestinal bypass is not recommended.

Conservative treatment should be continued if the patient is improving as demonstrated by decreasing output, rising plasma albumin level and body weight and return of defecation. Spontaneous closure is most likely to take place within 4 to 6 weeks of sepsis and is unlikely to happen later. Reher et al observed that 90% of patients who closed their fistulas did so within 1 month after sepsis was controlled. Less than 10% closed in 2 months and

none after 3 months. Fazio showed that surgical mortality and success rate when surgery was done before and after 6 weeks was 21 and 70% and 12 and 84% respectively. Thus elective surgery is best undertaken atleast 4 to 6 weeks after resolution of intra abdominal sepsis, which is usually 60 to 75 days after initial surgery.

Sitages-Serra et al suggested that group 1a and 3 fistulas can be treated conservatively. Group 1a cases are started on TPN immediately, with surgery reserved for those cases that do not close or if sepsis is controlled. Group 2 fistulas demand early surgery with post operative TPN.

Once the decision for surgery is made, careful preparation should begin. The abdominal wall should be reevaluated, loculations drained and cellulitis aggressively treated. If meticulous skin care and control of fistula drainage has been achieved, the operation can be carried out through a healthy abdominal wall, enhancing the chance of secure abdominal closure. Particular attention should be paid to electrolyte and volume status preoperatively. Fistula drainage should be cultured and intraluminal antibiotics as well as targeted intravenous antibiotics should be administered. If the patient has been receiving enteral nutrition therapy,

discontinuation one to two days preoperatively may decrease abdominal distension and aid in attaining a secure abdominal closure.

The abdomen and operative site should be washed with antibacterial solutions for several days prior to operation. Bowel preparation, both mechanical and antibiotic preparation should be carried out. Systemic antibiotics should always be used, as these are by definition at least clean contaminated cases. Sufficient time should be allowed for this operation. Extensive dissection is usually necessary, with meticulous technique and absolute hemostasis for the prevention of further fistulization.

The operative approach is preferably though a new incision so that the major operative field is relatively clean.

If this is not possible, the old incision is used but extended for easier access to the abdomen. In addition, if sepsis still exists in the abdominal wall, the incision should be made remote from this area. Abscess cavity, if present should be drained through separate stab wounds distant from the primary incision. The operative incision should be planned so that if end-to-end anastomosis will be necessary which usually is the case, it can be carried out well away from the area of maximal contamination.

Dissection should proceed from the ligament of Treitz to the rectum with adhesions freed. The best rates of closure and the lowest incidence of complications are obtained by definitive resection and end-to-end anastomosis. The anastomosis should be carried out in a clean field away from any previous abscess cavity. The omentum should be placed in its anatomic position with a portion covering the anastomosis.

The importance of a secure abdominal wall closure cannot be overstated. This may be difficult in patients in whom the abdominal wall has been partially destroyed by sepsis. If closure is complicated, a Plastic Surgery Team should be employed to assist in this portion of the operation. In general, prosthetic reconstruction can lead to recurrent fistulas or become infected when used in these contaminated cases. Musculocutaneous flaps should be used if adequate fascia is not available for a tension free closure.

FACTORS INFLUENCING THE OUTCOME OF ECF

A review of literature has revealed eight important factors that influence outcome in ECF. These are:

1. Local fistula characteristics:

Lower rates of spontaneous closure and higher mortality have been associated with distal obstruction, epithelialisation of the tract, short tracts less than 2 cm, complete disruption, diseased adjacent bowel, multiple fistulas, abdominal wall defects etc.

2. Organ of origin:

Spontaneous closure is more frequent and mortality is lower in biliopancreatic than duodeno-jejunoileal fistulas.

3. Sepsis:

Presence of sepsis decreases the rate of spontaneous closure and increases mortality. Reber reported spontaneous closure in 90% of patients where sepsis was controlled and in only 6% when sepsis was not controlled,

with 85% mortality in the latter group. Levy et al reported mortality rates of 55 and 20% respectively in the presence and absence of sepsis.

4. Etiology:

Postoperative fistulas have a higher mortality but are more likely to close spontaneously. Presence of cancer significantly increases mortality rates. Fistulas associated with IBD, cancer or radiations have lower rates of spontaneous closure.

5. Age:

Age of the patient influences mortality, but not spontaneous closure. Reber reported mortality rates of 22% and 48% in patients below and above 65 years respectively, while Levy reported mortality rates of 20% and 45% in patients below and above 50 years. Edelman observed mortality of 65% in patients above 65 years and 20% in those below 40 years.

6. Fistula Output:

Edmunds, Sitges –serra and Levy observed mortality rates of 54%, 32% and 50% for high output fistulas and 16%, 6% and 26% for low output fistulas respectively.

7. Nutritional Status:

Chapman observed a mortality rate of 12% and spontaneous closure in 89% of patients with ECF who received more than 3000 kcal/24 hrs. But in patients who received less than 1000 kcal/24 hrs, the corresponding values were 55% and 37%. Coutsoffides reported mortality rates of 32% and 4% in the malnourished and well-nourished respectively.

Serum visceral protein levels can be used to predict the outcome in ECF. Fazio reported mortality rates of 0% and 42% in patients with serum albumin above 3.5 gm/dl and below 2.5 gm/dl respectively. Kuvshinoff et al reported that serum transferrin levels of > 200 mg/dl were predictive of spontaneous closure.

8. Duration of fistula:

Acute ECF are more likely to close spontaneously than chronic ones but the mortality is higher for acute than chronic fistulas. Edelman reported a mortality of 40%, if the fistula appeared within five days and only 23% if it appeared more than 15 days after surgery.

Various authors have used a combination of factors to identify classes with different risks of mortality. Sitges – serra classified fistulas into four groups with mortality ranging from 60% in group 2 to 0% in group 3 and spontaneous closure of 7% in group 2 and more than 90% in group 1a and group 3. When this classification was used in treating patient prospectively, mortality rates reduced and spontaneous closure increased.

Fujita et al proposed four degrees of ECF depending on presence of abscess/peritonitis with mortality ranging from 0% to 65% in these classes Levy classified fistulas into four classes based on 12 risk factors with mortality of 0%, when no risk factor was present and 86% when two or more risk factors present. Altomare el at developed a fistula prognostic score using four factors: Sepsis, serum albumin, high output and locally unfavorable conditions. Later they proposed a prognostic index based on logistic regression analysis using two risk factors – Apache II score and serum albumin levels. Most of the prognostic factors identified can be included in the Apache II score or may have relevance in determining the Apache II score, so that this variable alone can indicate the relative importance of these risk factors fairly accurately. They used this to evaluate prospectively patients with ECF and obtained an accuracy of 94%, positive predictive value of 92% and negative predicted value of 100%.

MATERIALS AND METHODS

This was a prospective and retrospective study conducted at the Government Royapettah Hospital, Kilpauk Medical College, Chennai. The period of study was from June 2005 to September 2007. All patients with ECF were enrolled in this study. Patients with biliary, pancreatic, and anal fistulas were excluded.

Initial management for all patients was conservative, with restoration of fluid and electrolyte balance being given the first priority. All patients were initially started on parenteral nutrition using 10% dextrose, Astymine, and human albumin. Later some were switched over to enteral feeds depending on the clinical situation.

Patients with clinical features of sepsis were subjected to an ultrasound examination and treated with transperitoneal drainage. Emergency surgical intervention was undertaken only in patients who had an intra-abdominal abscess. Diversion procedures were undertaken in some patients at this time. Elective surgical closure was done if the fistula failed to close spontaneously after four weeks of conservative management.

ECF From Inguinal Hernia

A Proforma was made and all cases of enterocutaneous fistulas were followed up from the day of recognition of fistula and till the date of discharge. Details regarding types of surgery performed, category of the fistula, and origin of fistula were collected. Management policies for each patient are individualized and details of management were taken down.

Analysis of morbidity and mortality were taken into the study.

A thorough retrospective analysis of all cases was made to chalk out the principles for prevention of enterocutaneous fistulas.

EC FISTULA FROM THE SITE OF INCISION AND DRAINAGE

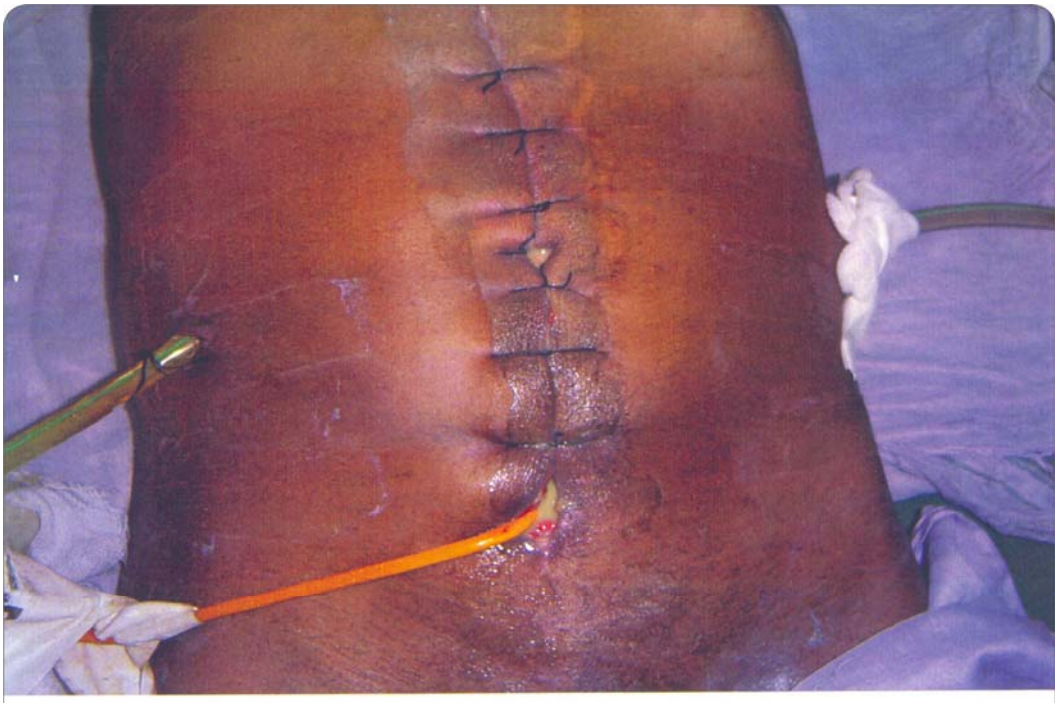
OBSERVATIONS

A total of 31 patients were studied. There were 20 males and 11 females in this group. The age of the patients ranged from 10-70 years with mean age of 39 years. Majority of the fistulas were observed in patients in the age group of 31 to 60 years – 16 patients.

Out of 31 fistulas, 29 were postoperative. One was due to trauma and other a case of strangulated inguinal hernia. Among the former group, 70% developed a fistula following emergency surgery. The mean interval between the initial surgery and the appearance of fistula was 9 days.

Ileal fistulas were the most common accounting for 48% of the patients.

ORIGIN	NO. OF PATIENTS
STOMACH	3 (9.67%)
DUODENUM	4 (12.90%)
JEJUNUM	3 (9.67%)
ILEUM	15 (48.38%)
COLON/APPENDIX	6 (19.35%)



Fistula through ECF
Primary abdominal Wound

Among the surgeries responsible for ECF, perforation closure accounted for the maximum in 11 patients.

OPERATIONS	NO. OF PATIENTS
Perforation Closure	11
Subtotal Gastrectomy	3
Adhesiolysis	2
Intestinal Resection & Anastomosis	9
Emergency appendicectomy	1
Others	5

Out of 31 patients, 15 had high output and 16 had low output fistulas.

Location	Number of Patients	
	High output	Low output
Stomach	2	1
Duodenum	4	-
Jejunum	3	-
Ileum	6	9
Colon	-	6

Among the prognostic/severity factors studied, sepsis was occurring in 10 patients of whom 7 had an intra-abdominal abscess one had urinary tract infection and 2 had catheter related sepsis. Malnutrition was seen in 11 patients, hypoalbuminemia in 5 patients. Thirteen patients had a large abdominal wall defect, 6 had cardiorespiratory problem and 11 were above 51 years.

Of the 31 patients, four had no severity factors, 14 had one factor, and the remaining had four or more severity factors.

RISK FACTORS AND OUTCOME

Risk factors	No. of Patients	Spontaneous closure	Operative closure	Dead
Age >51 years	11	4	3	4
Sepsis	10	2	6	2
Malnutrition	11	3	5	3
Large abdominal wall defect	13	3	6	4
High output	15	4	7	4
Sr. Albumin < 3 gm%	5	-	-	5

Complications included skin excoriation around the fistula in 7 patients, cardiopulmonary complication in 6, bedsores in 3 patients. The commonest electrolyte imbalance was hyponatremia occurring in 8 patients.

RESULTS

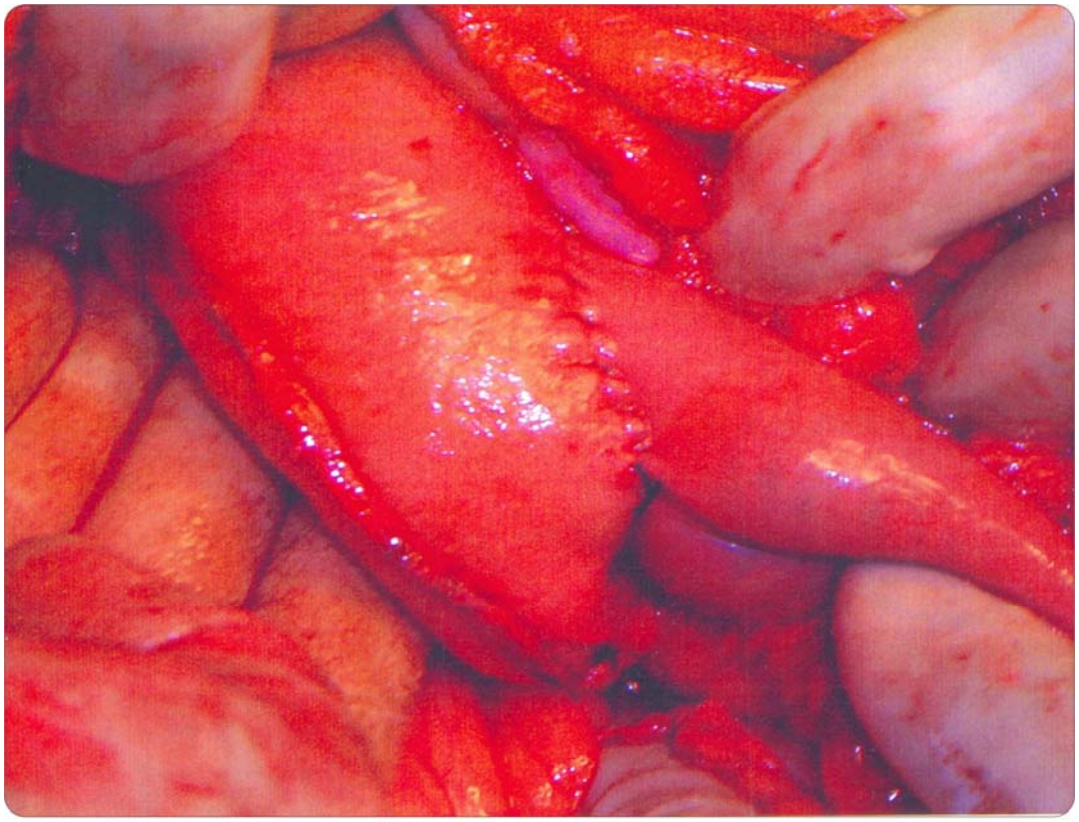
Fistulas closed in 11 patients spontaneously. Operative closure was needed in 15 patients. Death occurred in 5 patients with a mortality rate of 16.12%.

FINAL OUTCOME

Outcome	No. of Patients
Closed by surgical intervention	15
Spontaneous closure	11
Death	5

In two patients, death was due to uncontrolled sepsis, in two patients aspiration causing death. Thromboembolism caused death in one patient. Out of five deaths, four were above 51 years of age. All five patients died during the initial conservative treatment period.

Surgical closure was achieved by resection and anastomosis in a majority of patients.



APPENDICECTOMY WHICH RESULTED IN POST OP EC FISTULA

ORGAN OF ORIGIN AND OUTCOME

Organs	Spontaneous Closure	Operative Closure	Death	Total Patients
Stomach	1	-	2	3
Duodenum	3	-	1	4
Jejunum	1	2	-	3
Ileum	3	11	1	15
Appendix/Colon	3	2	1	6
Total	11	15	5	31

Patients with single or no risk factors, had no mortality whereas mortality steadily rose as risk factors accumulated.

The mean duration of the fistula closure was achieved in 28 days in case of spontaneous closure.

Among the risk factors analyzed, the presence of a large abdominal wall defect and high output fistulas were significantly associated with failure of the fistula to close spontaneously

ILEAL PERFORATION WHICH RESULTED IN EC FISTULA AFTER CLOSURE

Hypoalbuminemia, malnutrition and sepsis were associated with high mortality.

Serum albumin levels measured at the beginning of treatment showed no significant difference between patients who had spontaneous closure and those who did not, but there was a significant difference in serum albumin levels at the beginning of treatment between survivors and non-survivors.

EFFECTS OF TPN

Effects of TPN	**No. of Cases**
Spontaneous Closure	8
Improvement in general Condition	6
Catheter Sepsis	2

In evaluating the effects of TPN:

- It increases the spontaneous closure rate of fistulas.
- It has contributed to decreased mortality in patients with fistula.

SPONTANEOUS RECOVERY FROM EC FISTULA

- Even if spontaneous closure has not been achieved because of complex fistula anatomy, the patients were in a better condition to be taken up for definite surgery.

POST OP PICTURE SHOWING RECOVERY FROM EC FISTULA

DISCUSSION

The outcome of treatment of enterocutaneous fistulas vary widely from hospital to hospital, mortality rates quoted in literature varies from 6.25% to 60%. Spontaneous closure occurs in 30 to 70%. This is because of the heterogeneous nature of this condition. This study revealed a mortality rate of 16.12% and spontaneous closure rate of 35.48% which is similar to other studies in literature. Ileal fistulas in this study closed spontaneously in 20% of the cases, which is also similar to other series where the rates are less than 40%, despite it being an anatomically favourable location.

Among the factors analyzed, the only factor that was predictive of spontaneous closure was the size of the abdominal wall defect. It was found that malnutrition, hypoalbuminemia and large abdominal wall defect were all predictive of mortality. Altomare et al showed that sepsis, serum albumin and high output were significantly related to the risk of death in ECF, which is similar to our study.

In this study, spontaneous closure occurred within 35 days of appearance of the fistula in all cases, with the mean of 28 days, which is

similar to other studies. Operative closure was undertaken between 4-6 weeks except in one case, where it was done in the first week along with emergency drainage of an intra-abdominal abscess.

In the 11 patients who had spontaneous closure, only two had sepsis (controlled) three had malnutrition (corrected) and three had large abdominal wall defect. None of them had hypoalbuminemia. Mortality in this series was due to a combination of risk factors, with the rate increasing as these factors accumulated.

Among the 15 cases that needed operative closure, 6 had distal obstruction, 6 had sepsis, 6 had large abdominal wall defect.

Although serum albumin levels at the appearance of the fistula did not predict spontaneous closure, it was predictive of mortality. The albumin levels after three weeks of treatment however were predictive of both spontaneous closure and mortality. This shows that improving the nutritional status of the patient, as evidenced by the increase in serum albumin levels, after three weeks of treatment increases the chances of spontaneous closure. Similarly failure to correct malnutrition as evidenced by decreased serum albumin levels after three weeks increases the mortality.

Altomare et al reported a statistically significant difference in albumin levels between survivors and nonsurvivors.

In this study, it is also clear that TPN increases the spontaneous closure rate and decreases the mortality.

PRINCIPLES OF PREVENTION

Since operations account for most of the enterocutaneous fistulas, if we adopt certain principles, we can effectively prevent this humiliating and demoralizing phenomenon.

Preoperative measures:

- Effective bowel sterilization
- Good nutritional support
- Avoid radiotherapy

Intra operative measures:

- Sound Technical principle
- Anastomosis in healthy bowel with adequate blood supply.
- Anastomosis without tension
- Proper hemostasis
- Anastomosis covered with omentum

- Extra care being taken in patients with malignant lesion.

Post operative measures:

- Proper antibiotic therapy.
- Early management of focal sepsis
- Good Nutrition support.

If attention is paid to all the several aspects of these preventive measures, gastrointestinal fistula following surgery can no longer be a nightmare to the surgeon.

CONCLUSION

All cases of enterocutaneous fistulas should be regarded as a challenge by the surgeon.

It may be concluded from this study:

- Operations account for the majority of enterocutaneous fistulas
- Surgical interventions for neoplastic lesions commonly result in enterocutaneous fistulas.
- Anatomical origin of fistula, bowel wall defect, associated adverse factors like sepsis, malnutrition, serum albumin level, and abdominal wall defect influence the spontaneous closure.
- Total parental nutrition increases the rate of spontaneous closure of fistulas and also decreases the mortality rate.

Definitive surgery should be carried out in the following patients:

- Spontaneous closure not occurred even after four to six weeks of conservative therapy

- Patients having complex fistula anatomy

- Patients having distal bowel obstruction

PROFORMA

Name: Age/Sex:

I.P. No:

D.O.A: D.O.S.:

D.O.D:

History:

Clinical features:

Investigations:

Diagnosis:

Procedure Done:

Post op. Period:

Recognition of Fistula:

Day: Output: Other symptoms:

Malnutrition:

Abdominal wall defect:

Phase I Stabilization:

Phase II Investigations:

Serum Albumin

Fistulogram

USG. Abdomen

Others:

Decision: Conservative/Surgical:

Outcome:

Study Details

Surgery Performed:

Origin of fistula:

Output:

Management:

Outcome:

Duration of Hospital Stay:

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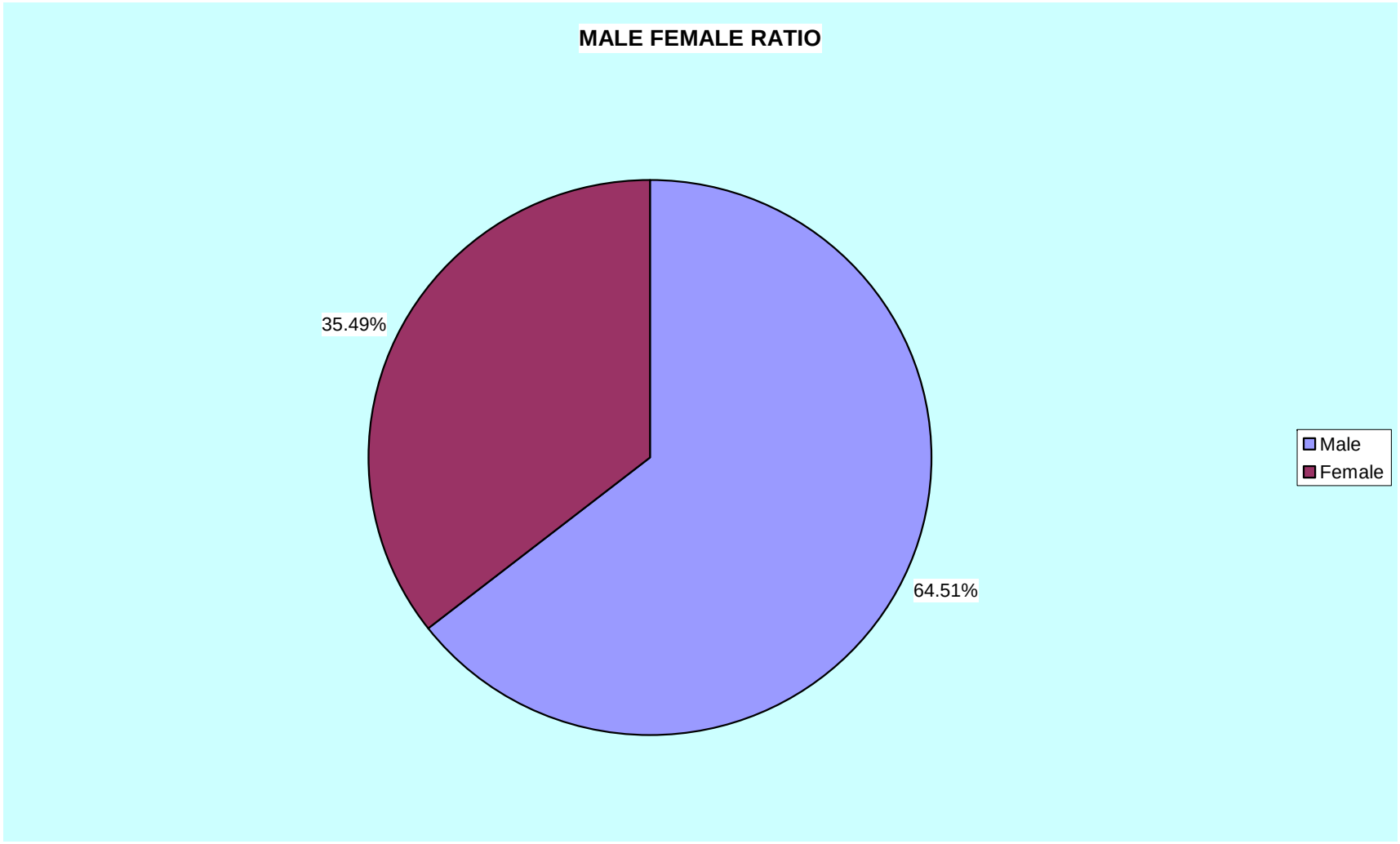
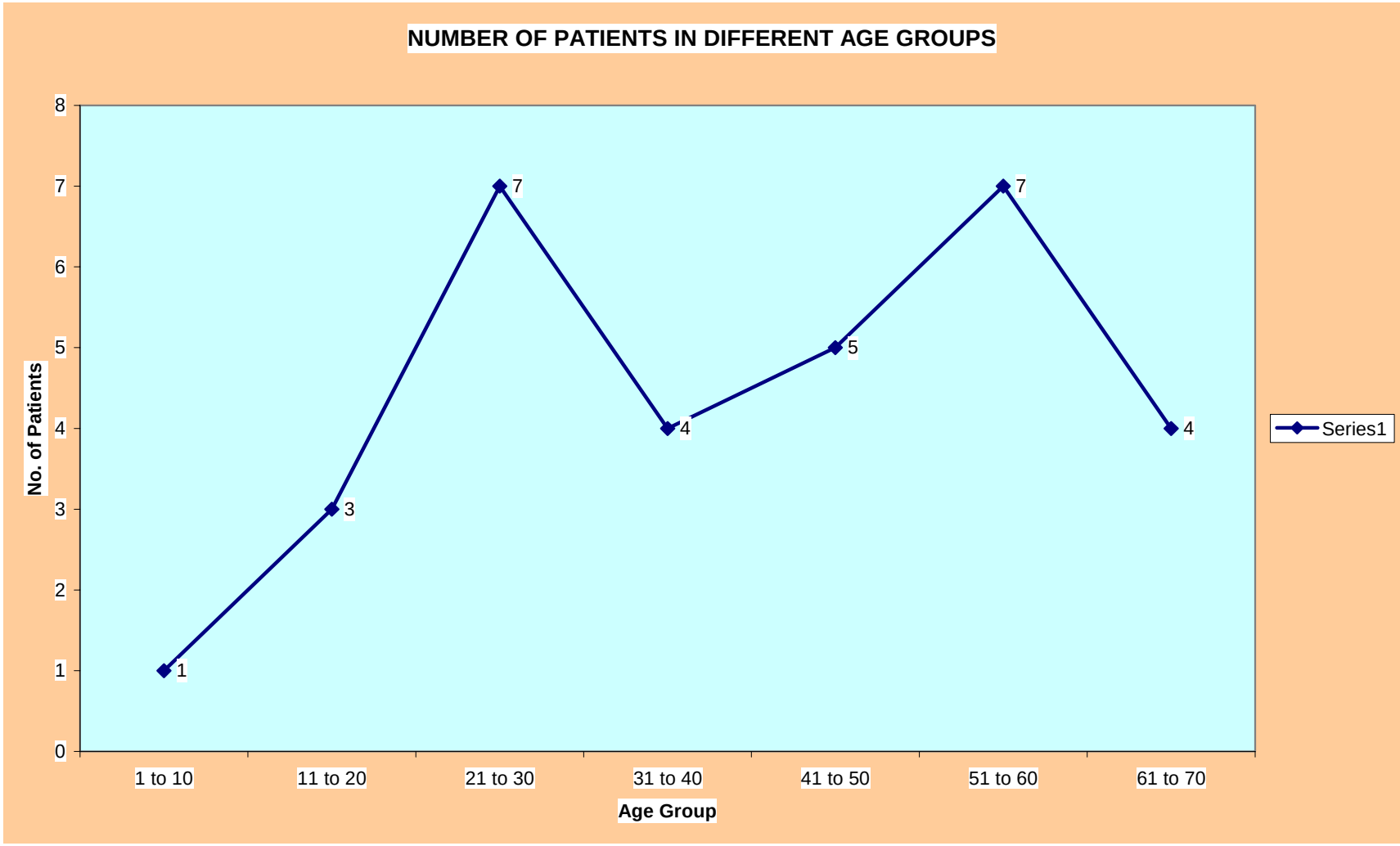
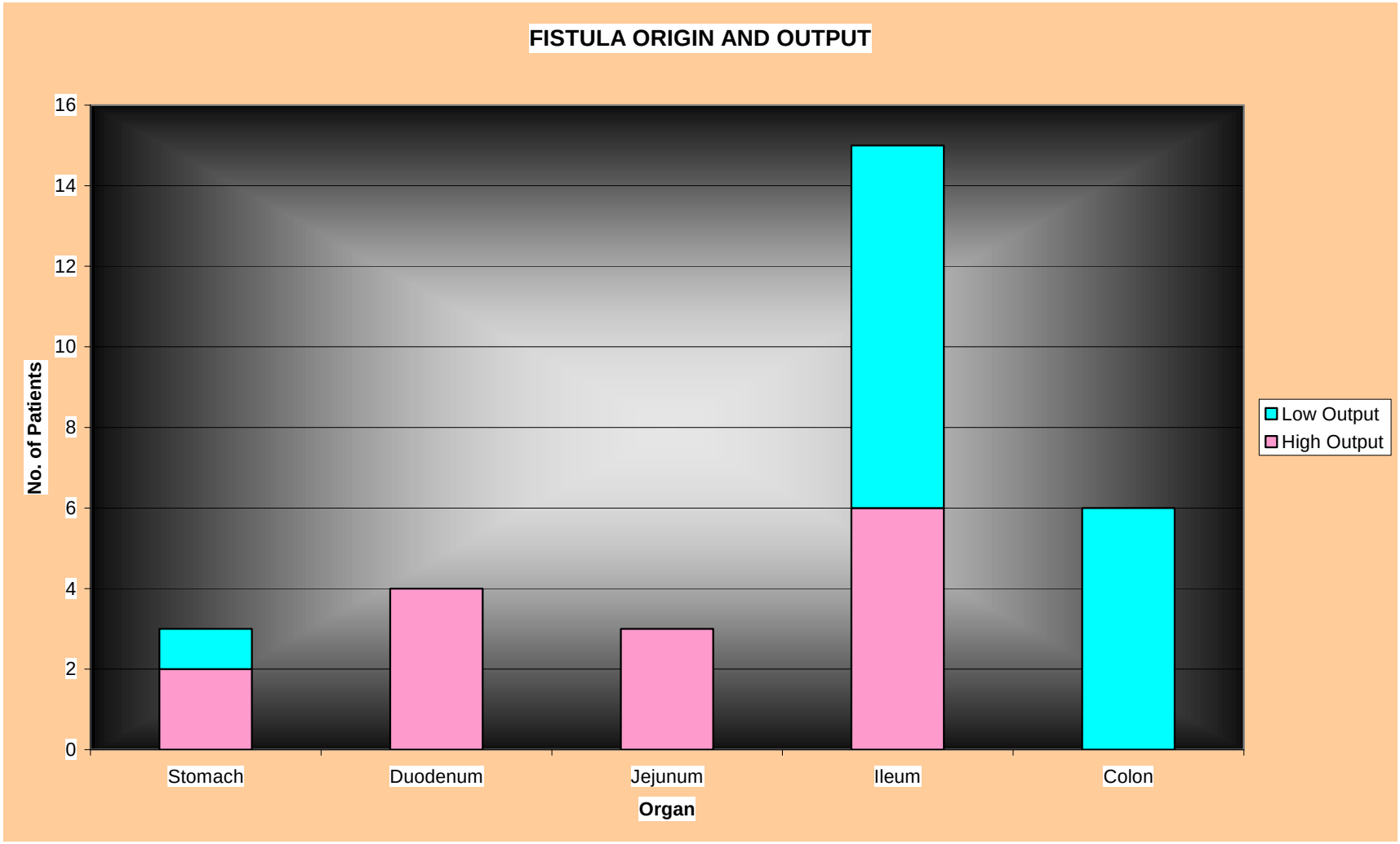
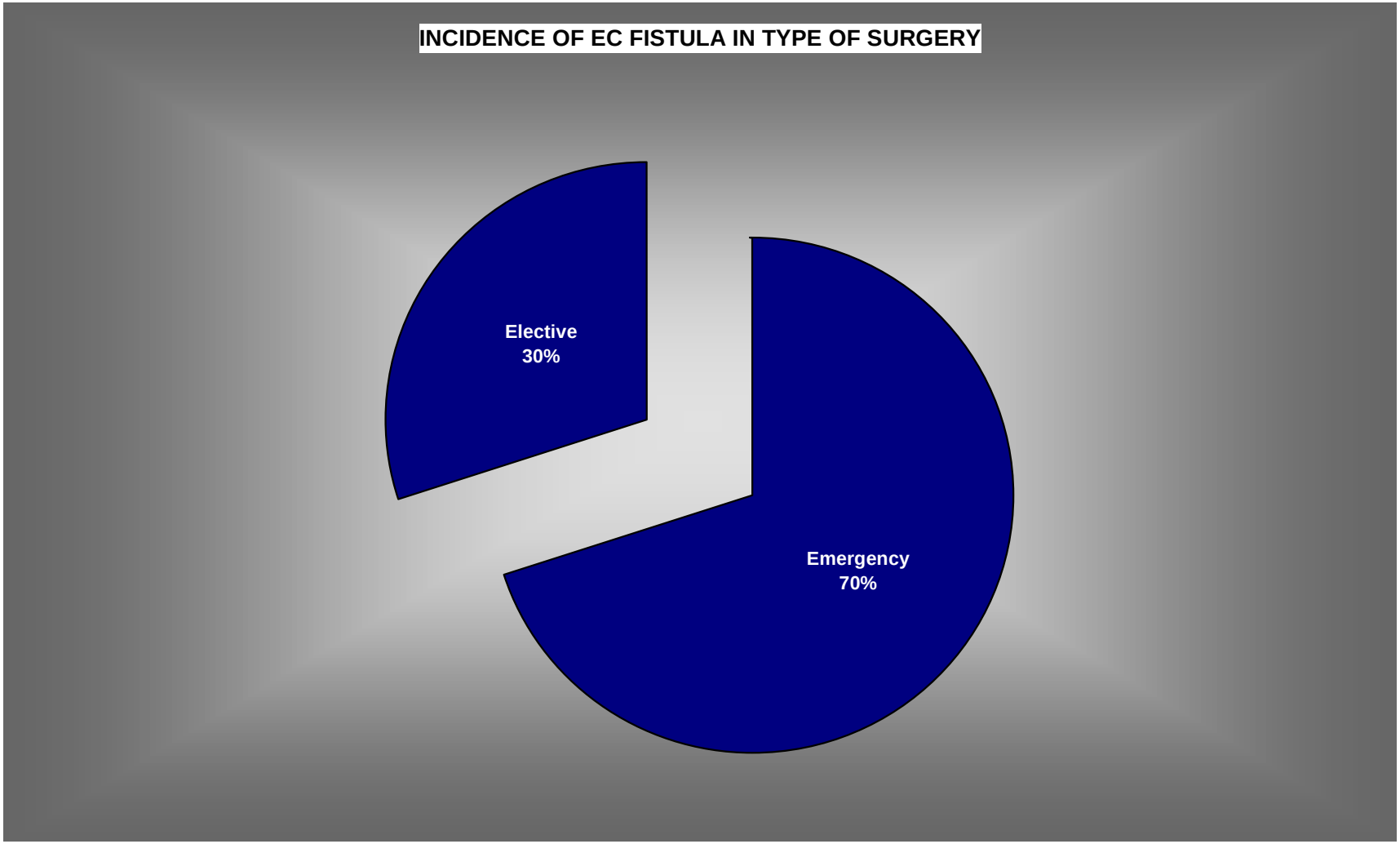
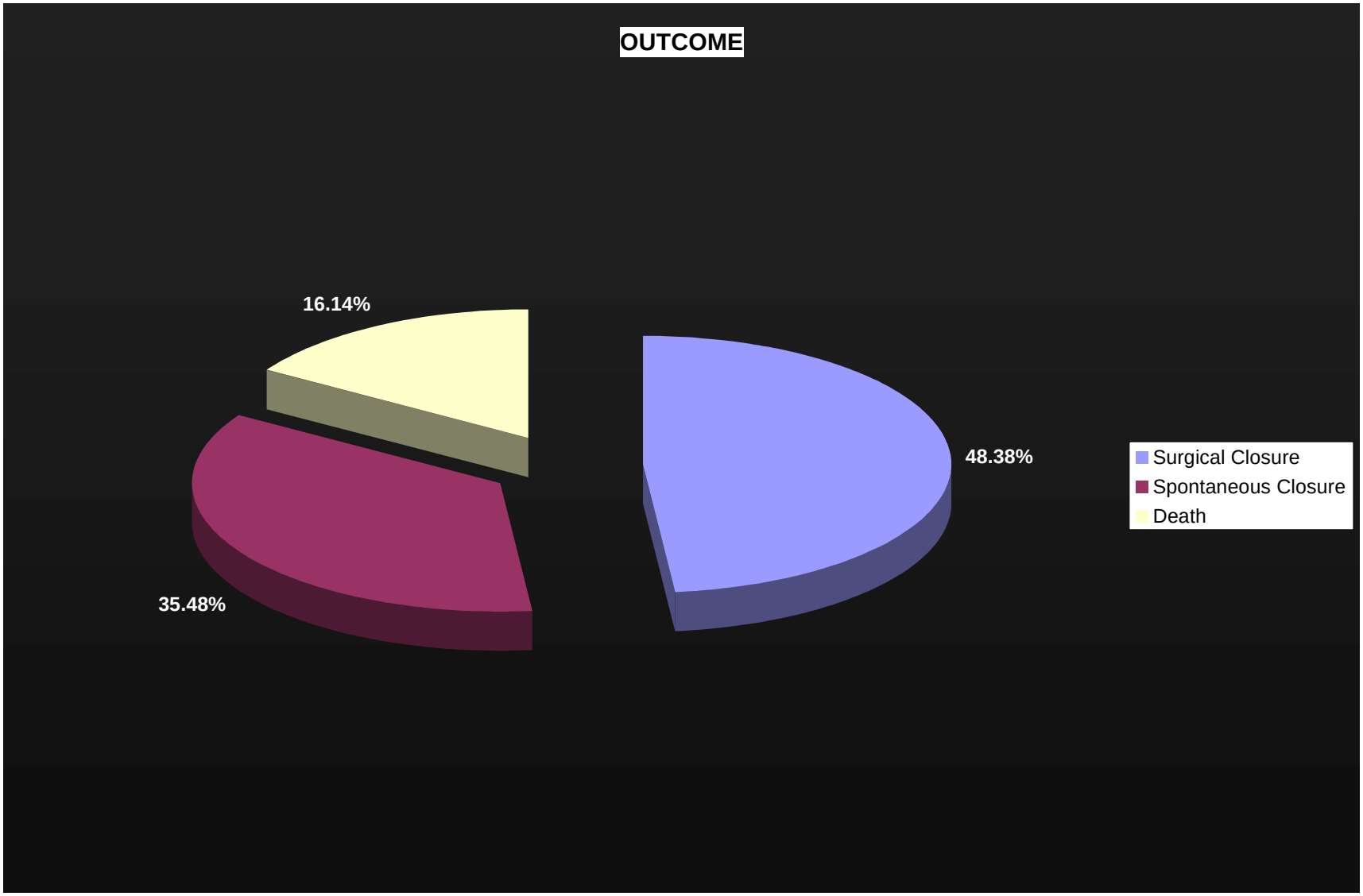

MALE FEMALE RATIO
35.49%
64.51%
Male
Female


NUMBER OF PATIENTS IN DIFFERENT AGE GROUPS
No. of Patients
0
1
2
3
4
5
6
7
8
1
3
7
4
5
7
4
1 to 10
11 to 20
21 to 30
31 to 40
41 to 50
51 to 60
61 to 70
Age Group
Series1


FISTULA ORIGIN AND OUTPUT
No. of Patients
16
14
12
10
8
6
4
2
0
Stomach
Duodenum
Jejunum
Ileum
Colon
Organ
Low Output
High Output


INCIDENCE OF EC FISTULA IN TYPE OF SURGERY
Elective
30%
Emergency
70%


OUTCOME
16.14%
48.38%
35.48%
Surgical Closure
Spontaneous Closure
Death

S.No.	Name	Age	Sex	IPNo.	Clinical Diagnosis	Initial Surgery	Fistula Origin	Output	Ab wall defect	Sepsis	Diagnosis	S.Albumin	Out come	Closure	Definitive Surgery	Cause of death
1	Panjali	30	F	860311	Hollow viscus perf.	Ileal perf. closure	Ileum	Low	-	Present	Enteric fever		Closed	Spontaneous	-	
2	Shaheena	55	F	871312	Intestinal obstruction	Gangrenous bowel resection and anastomosis	Colon	Low	-		Ca ascending colon		Closed	Spontaneous	-	
3	Jesudas	49	M	861031	Intestinal obstruction	Adhesiolysis	Ileum	High	Present	-			Closed	Surgical	Resection and anastomosis	
4	Kamala	55	F	861059	Sigmoid growth	Resection and anastomosis	Colon	Low	-		Ca sigmoid colon		Closed	Surgical	Resection and anastomosis	
5	Patchammal	65	F	860032	Ca rectum	Anterior resection	Ileum	High	Present	-	Ca rectum		Recovery	Surgical	Resection and anastomosis	
6	Jagadeeswari	42	F	859989	Hollow viscus perf.	Ileal perf. closure	Ileum	High	Present	Present	Enteric fever		Closed	Surgical	Resection and anastomosis	
7	Muthaiah	61	M	870012	Ca stomach	Subtotal gastrectomy	Stomach	Low	-	-	Ca stomach		Closed	Spontaneous		
8	Vetrivel	53	M	863221	Hollow viscus perf.	Ileal perf. closure	Ileum	Low	-	-	Enteric fever		Closed	Surgical	Resection and anastomosis	
9	Karim	42	M	861111	Blunt injury abdomen	Jejunal rent closure	Jejunum	High	-	-	Trauma		Closed	Surgical	Simple closure	
10	Ramesh	9	M	860132	Appendicitis	Appendicectomy	Appendicular stum	Low	-	-	Appendicitis		Closed	Spontaneous		
11	Devendran	33	M	866322	RTA	Primary wound closure	Sigmoid	Low	-	-	Trauma		Recovery	Surgical	Diversion colostomy	
12	Srikumar	21	M	871124	Hollow viscus perf.	DU perf. closure	Duodenum	High	Present	-	DU perf.		Closed	Spontaneous		
13	Mannu	59	M	869389	Ca stomach	Sub total gastrectomy	Stomach	High	Present	-	Ca stomach	< 3 gm %	Died			Aspiration
14	Srinath	68	M	867321	Cholelithiasis	Cholecystectomy / CBD exploration	Duodenum	High	Present	-		< 3 gm %	Died			Thromboembolism
15	Gugan	47	M	871121	Chronic pancreatitis	Pancreatico jejunostomy	Jejunum	High	Present	Present	Chronic pancreatitis		Recovery	Surgical	Resection and anastomosis	

16	Srinivas	70	M	873519	Intestinal obstruction	Resection and anastomosis	colon	Low	-	-	Ca ascending colon		Closed	Spontaneous		
17	Gomathi	37	F	863245	Intestinal obstruction	Adhesiolysis	Jejunum	High	-	-			Closed	Spontaneous		
18	Sabapathy	42	M	877112	Hollow viscus perf.	Ileal perf. closure	Ileum	High	Present				Closed	Surgical	Resection and anastomosis	
19	Malar	25	F	871142	Hollow viscus perf.	Ileal perf. closure	Ileum	Low	-	Present	Enteric fever		Recovery	Surgical	Resection and anastomosis	
20	Suresh	21	M	873241	Hollow viscus perf.	DU perf. closure	Duodenum	High	Present	-	DU perf.		Closed	Spontaneous		
21	Baskar	19	M	874215	Intestinal obstruction	Gangrene bowel resection and anastomosis	Ileum	Low	-	-			Recovery	Surgical	Resection and anastomosis	
22	Raju	20	M	875632	Multiple splenic abscess	Splenectomy	Ileum	Low	-	-	Chron's disease		Recovery	Surgical	Resection and anastomosis	
23	Velumani	60	M	863215	Abscess inguinal region	I & D	Ileum	Low	-	-	Obstructed Inguinal hernia		Closed	Spontaneous		
24	Ashwin	40	M	871142	Hollow viscus perf.	DU perf. closure	Duodenum	High	Present	-	DU perf.		Closed	Spontaneous		
25	Pankajam	26	F	880032	Hollow viscus perf.	Ileal perf. closure	Ileum	High	Present	Present	TB		Recovery	Surgical	Diversion Ileostomy	
26	Durai	13	M	873214	Intestinal obstruction	Resection and anastomosis	Ileum	Low	-	Present			Recovery	Surgical	Ileostomy	
27	Sangeetha	21	F	880351	Hollow viscus perf.	Ileal perf. closure	Ileum	High	Present	Present	Enteric fever	< 3 gm %	Died			Sepsis
28	Ramanathan	58	M	881321	Ca Stomach	Sub total gastrectomy	Stomach	High	Present	-	Ca stomach	< 3 gm %	Died			Aspiration
29	Gowri	36	F	884321	Appendicitis	Meckel's diverticulectomy	Ileum	Low	-	Present			Closed	Spontaneous		
30	Balaraman	55	M	885536	Ca colon	Resection and anastomosis	Colon	Low	-	Present	Ca sigmoid colon	< 3 gm %	Died			Sepsis
31	Malarvizhi	27	F	881573	Hollow viscus perf.	Ileal perf. closure	Ileum	Low	-	Present	Enteric fever		Recovery	Surgical	Resection and Anastomosis	

ABBREVIATIONS

Ca	-	Carcinoma
CBD	-	Common bile duct
CVP	-	Central venous pressure
DU	-	Duodenal ulcer
EC	-	Enterocutaneous
ECF	-	Enterocutaneous fistula
IBD	-	Inflammatory bowel disease
NG	-	Nasogastric
Perf	-	Perforation
Post op	-	Post operative
Pre op	-	Pre operative
TPN	-	Total parenteral nutrition